Sep 03, 07 4:49 **x4_3_1.sas** Page 1/1

```
/* x4_3_1.sas */
/* Purpose:  */

title1 'Section 4.3.1.';

data a;
  input y x1 x2 x3;
  cards;
4.9 0 0 2
3.0 1 0 1
0.2 1 1 0
2.9 1 2 2
6.4 2 1 2
;

proc print data=a;
title2 'List of data';

proc reg data=a;
  model y=x1 x2 x3 /selection=rsquare mse;
title2 'All possible regressions.';

proc reg data=a;
  model y=x1 x2 x3 /selection=backward slstay=0.05 details;
title2 'Backward elimination. p-value to stay is 0.05.';

proc reg data=a;
  model y=x1 x2 x3 /selection=forward slentry=0.10 details;
title2 'Forward selection. p-value to enter is 0.10.';

proc reg data=a;
  model y=x1 x2 x3 /selection=stepwise slentry=0.50 slstay=0.40 details;
title2 'Stepwise regression. p-in is 0.50, p-out is 0.40.';

run;
```

Section 4.3.1. 1
List of data

Obs	y	x1	x2	x3
1	4.9	0	0	2
2	3.0	1	0	1
3	0.2	1	1	0
4	2.9	1	2	2
5	6.4	2	1	2

/><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><

Section 4.3.1. 2
All possible regressions.

The REG Procedure
Model: MODEL1
Dependent Variable: y

R-Square Selection Method

Number of Observations Read 5
Number of Observations Used 5

Number in Model	R-Square	MSE	Variables in Model
1	0.7082	2.12667	x3
1	0.0514	6.91433	x1
1	0.0377	7.01429	x2
2	0.8040	2.14273	x2 x3
2	0.7597	2.62750	x1 x3
2	0.1539	9.25130	x1 x2
3	0.9614	0.84500	x1 x2 x3

Section 4.3.1. 3
Backward elimination. p-value to stay is 0.05.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read 5
Number of Observations Used 5

Backward Elimination: Step 0

All Variables Entered: R-Square = 0.9614 and C(p) = 4.0000

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	21.02300	7.00767	8.29	0.2487
Error	1	0.84500	0.84500		
Corrected Total	4	21.86800			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-0.17500	1.05590	0.02321	0.03	0.8954
x1	1.45000	0.71860	3.44045	4.07	0.2929
x2	-1.40000	0.61283	4.41000	5.22	0.2627
x3	2.37500	0.51955	17.65761	20.90	0.1371

Bounds on condition number: 1.2444, 10.467

Backward Elimination: Step 1

Statistics for Removal
DF = 1,1

Variable	Partial R-Square	Model R-Square	F Value	Pr > F
x1	0.1573	0.8040	4.07	0.2929
x2	0.2017	0.7597	5.22	0.2627
x3	0.8075	0.1539	20.90	0.1371

Variable x1 Removed: R-Square = 0.8040 and C(p) = 6.0715

```
                              Section 4.3.1.                                4
               Backward elimination. p-value to stay is 0.05.

                             The REG Procedure
                              Model: MODEL1
                           Dependent Variable: y

                        Backward Elimination: Step 1

                            Analysis of Variance

                                       Sum of           Mean
Source                   DF          Squares         Square    F Value    Pr > F

Model                     2         17.58255        8.79127       4.10    0.1960
Error                     2          4.28545        2.14273
Corrected Total           4         21.86800


                   Parameter     Standard
      Variable      Estimate        Error   Type II SS  F Value  Pr > F

      Intercept      0.94545      1.43015      0.93645     0.44  0.5765
      x2            -0.87273      0.88271      2.09455     0.98  0.4270
      x3             2.30909      0.82570     16.75740     7.82  0.1076

                Bounds on condition number: 1.0182, 4.0727
--------------------------------------------------------------------------------

                        Backward Elimination: Step 2


                           Statistics for Removal
                                  DF = 1,2

                             Partial        Model
          Variable          R-Square     R-Square    F Value    Pr > F

          x2                  0.0958       0.7082       0.98    0.4270
          x3                  0.7663       0.0377       7.82    0.1076


           Variable x2 Removed: R-Square = 0.7082 and C(p) = 6.5503


                            Analysis of Variance

                                       Sum of           Mean
Source                   DF          Squares         Square    F Value    Pr > F

Model                     1         15.48800       15.48800       7.28    0.0739
Error                     3          6.38000        2.12667
Corrected Total           4         21.86800


                   Parameter     Standard
      Variable      Estimate        Error   Type II SS  F Value  Pr > F

      Intercept      0.40000      1.31450      0.19692     0.09  0.7808
      x3             2.20000      0.81522     15.48800     7.28  0.0739

                      Bounds on condition number: 1, 1
```



```
--------------------------------------------------------------------------------

                        Backward Elimination: Step 3
```

Section 4.3.1. 5
Backward elimination. p-value to stay is 0.05.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Backward Elimination: Step 3

Variable x3 Removed: R-Square = 0.0000 and C(p) = 22.8793

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	0	0	.	.	.
Error	4	21.86800	5.46700		
Corrected Total	4	21.86800			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	3.48000	1.04566	60.55200	11.08	0.0292

Bounds on condition number: 0, 0

All variables left in the model are significant at the 0.0500 level.

Summary of Backward Elimination

Step	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	x1	2	0.1573	0.8040	6.0715	4.07	0.2929
2	x2	1	0.0958	0.7082	6.5503	0.98	0.4270
3	x3	0	0.7082	0.0000	22.8793	7.28	0.0739

Section 4.3.1. 6
Forward selection. p-value to enter is 0.10.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read 5
Number of Observations Used 5

Forward Selection: Step 1

Statistics for Entry
DF = 1,3

Variable	Tolerance	Model R-Square	F Value	Pr > F
x1	1.000000	0.0514	0.16	0.7137
x2	1.000000	0.0377	0.12	0.7542
x3	1.000000	0.7082	7.28	0.0739

Variable x3 Entered: R-Square = 0.7082 and C(p) = 6.5503

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	15.48800	15.48800	7.28	0.0739
Error	3	6.38000	2.12667		
Corrected Total	4	21.86800			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	0.40000	1.31450	0.19692	0.09	0.7808
x3	2.20000	0.81522	15.48800	7.28	0.0739

Bounds on condition number: 1, 1

Forward Selection: Step 2

Statistics for Entry
DF = 1,2

Variable	Tolerance	Model R-Square	F Value	Pr > F
x1	1.000000	0.7597	0.43	0.5801
x2	0.982143	0.8040	0.98	0.4270

No other variable met the 0.1000 significance level for entry into the model.

Section 4.3.1. 7
Forward selection. p-value to enter is 0.10.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Summary of Forward Selection

Step	Variable Entered	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	x3	1	0.7082	0.7082	6.5503	7.28	0.0739

Section 4.3.1. 8
Stepwise regression. p-in is 0.50, p-out is 0.40.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read 5
Number of Observations Used 5

Stepwise Selection: Step 1

Statistics for Entry
DF = 1,3

Variable	Tolerance	Model R-Square	F Value	Pr > F
x1	1.000000	0.0514	0.16	0.7137
x2	1.000000	0.0377	0.12	0.7542
x3	1.000000	0.7082	7.28	0.0739

Variable x3 Entered: R-Square = 0.7082 and C(p) = 6.5503

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	15.48800	15.48800	7.28	0.0739
Error	3	6.38000	2.12667		
Corrected Total	4	21.86800			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	0.40000	1.31450	0.19692	0.09	0.7808
x3	2.20000	0.81522	15.48800	7.28	0.0739

Bounds on condition number: 1, 1

Stepwise Selection: Step 2

Statistics for Entry
DF = 1,2

Variable	Tolerance	Model R-Square	F Value	Pr > F
x1	1.000000	0.7597	0.43	0.5801
x2	0.982143	0.8040	0.98	0.4270

Variable x2 Entered: R-Square = 0.8040 and C(p) = 6.0715

```
                              Section 4.3.1.                                  9
               Stepwise regression. p-in is 0.50, p-out is 0.40.

                             The REG Procedure
                               Model: MODEL1
                          Dependent Variable: y

                        Stepwise Selection: Step 2

                           Analysis of Variance

                                        Sum of           Mean
Source                        DF       Squares         Square    F Value    Pr > F

Model                          2      17.58255        8.79127       4.10    0.1960
Error                          2       4.28545        2.14273
Corrected Total                4      21.86800


                   Parameter     Standard
      Variable      Estimate        Error   Type II SS  F Value  Pr > F

      Intercept      0.94545      1.43015      0.93645     0.44  0.5765
      x2            -0.87273      0.88271      2.09455     0.98  0.4270
      x3             2.30909      0.82570     16.75740     7.82  0.1076

                   Bounds on condition number: 1.0182, 4.0727
--------------------------------------------------------------------------------

                        Stepwise Selection: Step 3


                          Statistics for Removal
                                 DF = 1,2

                          Partial        Model
          Variable       R-Square     R-Square    F Value    Pr > F

          x2               0.0958       0.7082       0.98    0.4270
          x3               0.7663       0.0377       7.82    0.1076


                           Statistics for Entry
                                 DF = 1,1

                                          Model
         Variable        Tolerance     R-Square    F Value    Pr > F

         x1               0.818182       0.9614       4.07    0.2929


     Variable x2 Removed: R-Square = 0.7082 and C(p) = 6.5503
```

Section 4.3.1. 10

Stepwise regression. p-in is 0.50, p-out is 0.40.

The REG Procedure
Model: MODEL1
Dependent Variable: y

Stepwise Selection: Step 3

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	15.48800	15.48800	7.28	0.0739
Error	3	6.38000	2.12667		
Corrected Total	4	21.86800			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	0.40000	1.31450	0.19692	0.09	0.7808
x3	2.20000	0.81522	15.48800	7.28	0.0739

Bounds on condition number: 1, 1

Stepwise Selection: Step 4

Statistics for Entry
DF = 1,2

Variable	Tolerance	Model R-Square	F Value	Pr > F
x1	1.000000	0.7597	0.43	0.5801
x2	0.982143	0.8040	0.98	0.4270

All variables left in the model are significant at the 0.4000 level.

The stepwise method terminated because the next variable to be entered was just removed.

Summary of Stepwise Selection

Step	Variable Entered	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	x3		1	0.7082	0.7082	6.5503	7.28	0.0739
2	x2		2	0.0958	0.8040	6.0715	0.98	0.4270
3		x2	1	0.0958	0.7082	6.5503	0.98	0.4270